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What is claimed is:

1. An OVPN system comprising:
  - a plurality of converting sections, which are disposed so as to correspond to  
5 plural different first signal formats, for converting a first signal format and a second signal format alternately under conditions in which the first signal format which is used by a user's device which joins an OVPN (Optical Virtual Private Network) and a second signal format which is used in the OVPN are different from each other; and
  - an OVPN terminating device for containing the user's device, wherein  
10 the OVPN terminating device is provided with:
    - a registering section from the user's device for a first signal format type which is used in the user's device together with an IP address of the user's device and a VPNID;
    - a notifying section for notifying contents of the registration to other OVPN terminating device which controls the same VPNID as the user's device;
  - 15 a retrieving section for the first signal format type which corresponds to the IP address and the VPNID in the user's device according to a calling connection request from the user's device by referring to the information which is registered by the registering section, and
  - 20 a selecting section for selecting the first signal format which is used by the user's device according to a result in the retrieving section when data is transported from the user's device.
2. An OVPN terminating device for containing a user's device which joins an OVPN comprising:
  - 25 a plurality of converting sections, which are disposed so as to correspond to

plural different first signal formats, for converting a first signal format and a second signal format alternately under conditions in which the first signal format which is used by a user's device which joins the OVPN and a second signal format which is used in the OVPN are different from each other;

- 5        a registering section from the user's device for a first signal format type which is used in the user's device together with an IP address of the user's device and a VPNID;
- a notifying section for notifying contents of the registration to other OVPN terminating device which controls the same VPNID as the user's device;
- a retrieving section for the first signal format type which corresponds to the IP address and the VPNID in the user's device according to a calling connection request from the user's device by referring to the information which is registered by the registering section, and
- 10      a selecting section for selecting the first signal format which is used by the user's device according to a result in the retrieving section when data is transported from
- 15      the user's device.

3. An OVPN system comprising:

- a plurality of converting sections, which are disposed so as to correspond to plural different first signal formats, for converting a first signal format and a second signal format alternately under conditions in which the first signal format which is used by a user's device which joins an OVPN (Optical Virtual Private Network) and a second signal format which is used in the OVPN are different from each other; and
- 20      an OVPN terminating device for containing the user's device;
- a registering section for registering a first signal format type which is sent from
- 25      the user's device so as to be used in the user's device together with an IP address of the

user's device and a VPNID;

a notifying section for notifying the registered contents to other OVPN terminating device which controls a device which receives a calling connection request when the calling connection request arrives from the user's device;

- 5        a selecting section for selecting the first signal format which is used in a device which receives the calling connection request with reference to the registered contents for a function for corresponding to the other OVPN terminating device;
- a receiving and selecting section which receives the first signal format type information which is used in the device which receives the calling connection request
- 10      from the other OVPN terminating device so as to respond to a notice from the notifying section and selects the first signal format type which is used in the user's device according to the format type information.

4. An OVPN terminating device for containing a user's device which joins an OVPN  
15 comprising:

- a plurality of converting sections, which are disposed so as to correspond to plural different first signal formats, for converting a first signal format and a second signal format alternately under conditions in which the first signal format which is used by a user's device which joins the OVPN and a second signal format which is used in the  
20 OVPN are different from each other;

- a registering section for registering a first signal format type which is sent from the user's device so as to be used in the user's device together with an IP address of the user's device and a VPNID;

- a notifying section for notifying the registered contents to other OVPN  
25 terminating device which controls a device which receives a calling connection request

when the calling connection request arrives from the user's device;

a selecting section for selecting the first signal format which is used in a device which receives the calling connection request with reference to the registered contents for a function for corresponding to the other OVPN terminating device;

- 5 a receiving and selecting section which receives the first signal format type information which is used in the device which receives the calling connection request from the other OVPN terminating device so as to respond to a notice from the notifying section and selects the first signal format type which is used in the user's device according to the format type information.

10

5. An OVPN system comprising:

- a plurality of converting sections, which are disposed so as to correspond to plural different first signal formats, for converting a first signal format and a second signal format alternately under conditions in which the first signal format which is used 15 by a user's device which joins an OVPN (Optical Virtual Private Network) and a second signal format which is used in the OVPN are different from each other; and
- an OVPN terminating device for containing the user's device, wherein the OVPN terminating device is provided with:
- a registering section for registering at least a first signal format type which is sent from the user's device so as to be used in the user's device together with an IP 20 address of the user's device and a VPNID;
- a notifying and selecting section for notifying the registered contents to other OVPN terminating device which controls the device which receives the calling connection request from the user's device when the calling connection request arrives 25 from the user's device and selecting the first signal format type which can be used in the

user's device handled between other OVPN terminating device an the user's own device commonly according to the registered contents;

- a retrieving section a vacancy of the converting section for the alternate converting operation both in the user's own device and other OVPN device when the first  
5 signal format type which is selected by the selecting section is different from a second signal format type; and

a selecting section which selects at least either one of the converting section for the alternate converting operation which is not occupied for the user's own device and other OVPN device according to the retrieving result by the retrieving section.

10

6. An OVPN terminating device for containing the user's device comprising:  
a plurality of converting sections, which are disposed so as to correspond to plural different first signal formats, for converting a first signal format and a second signal format alternately under conditions in which the first signal format which is used  
15 by a user's device which joins an OVPN and a second signal format which is used in the OVPN are different from each other;  
a registering section for registering at least a first signal format type which is sent from the user's device so as to be used in the user's device together with an IP address of the user's device and a VPNID;  
20 a notifying and selecting section for notifying the registered contents to other OVPN terminating device which controls the device which receives the calling connection request from the user's device when the calling connection request arrives from the user's device and selecting the first signal format type which can be used in the user's device handled between other OVPN terminating device an the user's own device  
25 commonly according to the registered contents;

a retrieving section a vacancy of the converting section for the alternate converting operation both in the user's own device and other OVPN device when the first signal format type which is selected by the selecting section is different from a second signal format type; and

- 5        a selecting section which selects at least either one of the converting section for the alternate converting operation which is not occupied for the user's own device and other OVPN device according to the retrieving result by the retrieving section.

7. An OVPN terminating device according to any one of Claim 2, 4, or 6 wherein the  
10 registering section is provided with a section for registering a port identifier for the user's own device which corresponds to at least a first signal format which is used in the user's device or an interface identifier together with the IP address of the user's device and the VPNID.
- 15 8. An OVPN terminating device according to any one of Claims 2, 4, 6, or 7 which contains the converting section for the alternate converting operation in the user's own device.

9. A collective converting device comprising:
- 20        a plurality of converting sections, which are disposed so as to correspond to plural different first signal formats, for converting a first signal format and a second signal format alternately under conditions in which the first signal format which is used by a user's device which joins an OVPN and a second signal format which is used in the OVPN are different from each other; and
- 25        a section for performing the alternate converting operation which is disposed in

the OVPN terminating device according to Claims 2, 4, 6, and 7 commonly.

10. An optical communication network which is provided with:

an OVPN system according to any one of Claim 1, 3, and 5;

5 an OVPN terminating device according to any one of Claim 2, 4, 6, 7 and 8; and  
a collective converting device according to Claim 9.

11. An OVPN system comprising:

a plurality of converting sections, which are disposed so as to correspond to

10 plural different first signal formats, for converting a first signal format and a second  
signal format alternately under conditions in which the first signal format which is used  
by a user's device which joins an OVPN and a second signal format which is used in the  
OVPN are different from each other;

15 a retrieving section for detecting whether or not there is a section for performing  
the alternate converting operation so as to correspond to the signal format type under  
condition the first signal format is different from the second signal format when the first  
signal format type information which is used in the user's device is received;

20 a generating section for generating an IP address and a VPNID to the user's  
device when there is a section for performing the alternate converting operation as a  
result of the retrieving operation by the retrieving section; and

a registering section for registering the IP address, the VPNID generated by the  
generating section, and the first signal format type information which is used by the  
user's device to which the IP address and the VPNID are added.

25 12. An OVPN system which is disposed in an OVPN to which a plurality of

- sub-OVPNs are connected mutually comprising a plurality of converting sections, which are disposed so as to correspond to plural different first signal formats, for converting a first signal format and a second signal format alternately under conditions in which the first signal format which is used by a neighboring sub-OVPN and a second signal format which is used by the user's own sub-OVPN are different from each other.
13. An OVPN terminating device for containing a user's device which joins an OVPN comprising:
- a plurality of converting sections, which are disposed so as to correspond to plural different first signal formats, for converting a first signal format and a second signal format alternately under conditions in which the first signal format which is used by a user's device which joins the OVPN and a second signal format which is used in the OVPN are different from each other;
  - a retrieving section for detecting whether or not there is a section for performing the alternate converting operation so as to correspond to the signal format type under condition the first signal format is different from the second signal format when the first signal format type information which is used in the user's device is received;
  - a generating section for generating an IP address and a VPNID to the user's device when there is a section for performing the alternate converting operation as a result of the retrieving operation by the retrieving section; and
  - a registering section for registering the IP address, the VPNID generated by the generating section, and the first signal format type information which is used by the user's device to which the IP address and the VPNID are added.
- 25 14. An OVPN terminating device according to Claim 13 comprising:

- a selecting section for selecting a signal format which is used by the user who receives the calling connection request according to the first signal format type information which is used by the user's device having the IP address, included in the calling connection request, from which the calling connection request is transmitted
- 5 when the calling connection request is received form the user's device; and
- a transmitting section for transmitting the format type information which is selected by the selecting section to the user who receives the calling connection request together with the calling connection request.
- 10 15. An OVPN terminating device according to Claim 14 further comprising a notifying section which receives a response to the calling connection request so as to determine whether or not the signal format which is used by the user's device and the signal format which is employed by the user who receives the calling connection request coincides and notify that the signal formats do not coincide each other for setting up a circuit to the
- 15 user's device.
16. An OVPN terminating device according to Claim 13 which is provided with a notifying section for notifying a first signal format type information which corresponds to a vacant converting section for performing the alternate converting operation to the
- 20 user's device when the retrieving result in the retrieving section indicates that there is not a section for performing the alternate converting operation.
17. An OVPN terminating device according to Claim 13 comprising:
- an inquiring section for inquiring whether or not it is possible to change the
- 25 vacant converting section for performing the alternate converting operation to other

user's device which is under operation when the retrieving result by the retrieving section indicates that there is not a section for performing the alternate converting operation; and

- a requesting and generating section for requesting for changing the converting  
5 section for performing the alternate converting operation to other user device when the retrieving result by the retrieving section indicates that there is a section for performing the alternate converting operation and generating the IP address and the VPNID for the user's device.

- 10 18. A base point device which is disposed between the OVPN system according to Claim 1 or 2 and the user's device which is contained in the OVPN system or in a OVPN terminating device or between the OVPN system according to Claim 1 or 2 and the OVPN terminating device according to any one of Claims 3 to 7 comprising:  
Claim 1 or 2 and the user's device which is contained in the OVPN system or in a OVPN terminating device or between the OVPN system according to Claim 1 or 2 and the OVPN terminating device according to any one of Claims 3 to 7 comprising:  
a determining section for determining a first signal format type which is used in  
15 the user's device;  
a transmitting section for transmitting the format type information which is determined by the determining section to the OVPN terminating device; and  
a maintaining section for maintaining the generated IP address and the VPNID.

- 20 19. An OVPN system comprising:  
a plurality of converting sections, which are disposed so as to correspond to plural different first signal formats, for converting a first signal format and a second signal format alternately under conditions in which the first signal format which is used by a user's device which joins an OVPN and a second signal format which is used in the  
25 OVPN are different from each other;

- a retrieving section for detecting whether or not there is a section for performing the alternate converting operation so as to correspond to a plurality of the signal format types under condition the first signal format is different from the second signal format when the first signal format type information which is used in the user's device is received;
- 5        a generating section for generating a plurality of IP addresses which correspond to a plurality of format types and a VPNID to the user's device when there is a section for performing the alternate converting operation as a result of the retrieving operation by the retrieving section; and
- 10      a registering section for registering the VPNID which is added by the generating section, a plurality of IP addresses, and a plurality of the first signal format type information which are used by the user's device to which the VPNID and a plurality of the IP addresses are added; and
- 15      a section for employing the converting section for performing the alternate converting operation of the first signal format and the second signal format which correspond to the IP address which is contained in the calling connection request which is transmitted for a communication flowing the calling connection request by referring to the registering section when the calling connection request arrives from the user's device.
- 20      20. An OVPN terminating device for containing a user's device which joins an OVPN comprising:
- a plurality of converting sections, which are disposed so as to correspond to plural different first signal formats, for converting a first signal format and a second signal format alternately under conditions in which the first signal format which is used by a user's device which joins the OVPN and a second signal format which is used in the

OVPN are different from each other;

- a retrieving section for detecting whether or not there is a section for performing the alternate converting operation so as to correspond to a plurality of the signal format types under condition the first signal format is different from the second signal format
- 5 when the first signal format type information which is used in the user's device is received;
  - a generating section for generating a plurality of IP addresses which correspond to a plurality of format types and a VPNID to the user's device when there is a section for performing the alternate converting operation as a result of the retrieving operation by
  - 10 the retrieving section; and
    - a registering section for registering the VPNID which is added by the generating section, a plurality of IP addresses, and a plurality of the first signal format type information which are used by the user's device to which the VPNID and a plurality of the IP addresses are added; and
- 15 a section for employing the converting section for performing the alternate converting operation of the first signal format and the second signal format which correspond to the IP address which is contained in the calling connection request which is transmitted for a communication flowing the calling connection request by referring to the registering section when the calling connection request arrives from the user's device.
- 20
- 21. A base point device which is disposed between the OVPN system according to Claim 9 and the user's device which is contained in the OVPN system or in a OVPN terminating device or between the OVPN terminating device according to Claim 10 and the user's device which is contained in the OVPN system or in a OVPN terminating
- 25 device comprising:

a determining section for determining a first signal format type which is used in the user's device;

a transmitting section for transmitting the format type information which is determined by the determining section to the OVPN terminating device; and

5 a maintaining section for maintaining the a plurality of generated IP address, the VPNID, and a plurality of the first signal format type information.

22. An OVPN terminating device according to any one of Claim 13, 14, 15, 16, 17, or 20 which is provided with the converting section for performing the alternate converting  
10 operations in the user's own device.

23. A base point device according to Claim 18 or 21 which is provided with:  
a separating section for separating the user's device and the OVPN; and  
a returning section for returning a test beam which is transmitted from the  
15 OVPN back to the OVPN.

24. A collective converting device comprising:  
a plurality of converting sections, which are disposed so as to correspond to plural different first signal formats, for converting a first signal format and a second  
20 signal format alternately under conditions in which the first signal format which is used by a user's device which joins an OVPN and a second signal format which is used in the OVPN are different from each other; and  
a section for performing the alternate converting operation which is disposed in the OVPN terminating device according to any one of Claim 13, 14, 15, 16, 17, or 20  
25 commonly.

25. An optical communication network which is provided with:
- an OVPN system according to any one of Claim 11, 12, or 19;
  - an OVPN terminating device according to any one of Claim 13, 14, 15, 16, 17  
5 20, or 22;
  - a base point device according to Claim 18 or 21; and
  - a collective converting device according to Claim 24.
26. An OVPN system comprising:
- 10 a plurality of converting sections, which are disposed so as to correspond to plural different first signal formats, for converting a first signal format and a second signal format alternately under conditions in which the first signal format which is used by a user's device which joins an OVPN and a second signal format which is used in the OVPN are different from each other;
  - 15 a detecting section for detecting whether or not the user's device is connected;  
a generating section for adding the IP address and the VPNID to the user's device according to a control channel when the retrieving result in the detecting section indicates that the user's device is connected;
  - 20 a receiving and determining section for receiving at least a test signal which is transmitted via a data channel by using the IP address from the user's device and determining at least the first signal format type which belongs to the user's device;
  - 25 a retrieving section for retrieving whether or not there is a converting section for performing the alternate converting operation so as to correspond to the format type according to the determining result by the determining section when the first signal format type which is used by the user's device is different from the second signal format

type; and

- a registering section for registering the IP address which is added by the generating section, the VPNID, and the first signal format type information which is determined by the determining section which is used by the user's device to which the
- 5      VPNID and the IP address are added when the retrieving result by the retrieving section indicates that there is a converting section for performing the alternate converting operation.

27. An OVPN terminating device for containing a user's device which joins an OVPN
- 10     comprising:
- a plurality of converting sections, which are disposed so as to correspond to plural different first signal formats, for converting a first signal format and a second signal format alternately under conditions in which the first signal format which is used by a user's device which joins the OVPN and a second signal format which is used in the
- 15     OVPN are different from each other;
- a detecting section for detecting whether or not the user's device is connected;
- a generating section for adding the IP address and the VPNID to the user's device according to a control channel when the retrieving result in the detecting section indicates that the user's device is connected;
- 20     a receiving and determining section for receiving at least a test signal which is transmitted via a data channel by using the IP address from the user's device and determining at least the first signal format type which belongs to the user's device;
- a retrieving section for retrieving whether or not there is a converting section for performing the alternate converting operation so as to correspond to the format type
- 25     according to the determining result by the determining section when the first signal

format type which is used by the user's device is different from the second signal format type; and

- a registering section for registering the IP address which is added by the generating section, the VPNID, and the first signal format type information which is
- .5 determined by the determining section which is used by the user's device to which the VPNID and the IP address are added when the retrieving result by the retrieving section indicates that there is a converting section for performing the alternate converting operation.
- 10 28. An OVPN terminating device according to Claim 27 wherein the registering section is provided with a registering section for registering a port identifier or an interface identifier for the user's own device which corresponds to at least a first signal format which is used in the user's device commonly.
- 15 29. An OVPN terminating device according to Claim 27 or 28 which is provided with a converting section for performing the alternate converting operation in the user's own device.
30. A base point device which is disposed between the OVPN terminating device  
20 according to any one of Claim 27 to 29 and the user's device which is contained in the OVPN terminating device comprising:
- a detecting section for detecting whether or not the user's device is connected to the base point device;
- a receiving and maintaining section for receiving the IP address and the VPNID  
25 which are added to the base point device via the control channel from the OVPN

terminating device; and

a transmitting section for transmitting the test signal for at least the first signal format which is used by the user's device to the OVPN terminating device via the data channel after the IP address and the VPNID are added to the base point device.

5

31. A base point device according to Claim 30 which is provided with:

a separating section for separating the user's device and the OVPN; and

a returning section for returning a test beam which is transmitted from the OVPN back to the OVPN.

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32. A collective converting device comprising:

a plurality of converting sections, which are disposed so as to correspond to plural different first signal formats, for converting a first signal format and a second signal format alternately under conditions in which the first signal format which is used by a user's device which joins an OVPN and a second signal format which is used in the OVPN are different from each other; and

a section for performing the alternate converting operation which is disposed in the OVPN terminating device according to Claim 2 or 3 commonly.

20 33. An optical communication network which is provided with:

an OVPN system according to Claim 26, or an OVPN terminating device according to any one of Claims 27 to 29, or a base point device according to Claim 30 or 31, or a collective converting device according to Claim 7.

25 34. An OVPN system comprising:

a plurality of converting sections, which are disposed so as to correspond to plural different first signal formats, for converting a first signal format and a second signal format alternately under conditions in which the first signal format which is used by a user's device which joins an OVPN and a second signal format which is used in the

- 5 OVPN are different from each other, wherein

the converting section for performing the alternate converting operation is provided with:

a transmitting section the first signal format which is transmitted from the user's device to the OVPN by encapsulating the first signal format by the second signal format,

- 10 and

a transmitting section the encapsulated signal which is encapsulated by the second signal format which is transmitted from the OVPN to the user's device by de-encapsulating to the first signal format, and

the transmitting section to the OVPN is provided with:

- 15 a multiplying section for multiplying a plurality of signals by the second signal format which are directed to a common destination; and

the transmitting section to the user's device is provided with a separating section for the multiplied signal by the multiplying section into a plurality of signals.

- 20 35. An OVPN terminating device for containing a user's device which joins an OVPN comprising:

a plurality of converting sections, which are disposed so as to correspond to plural different first signal formats, for converting a first signal format and a second signal format alternately under conditions in which the first signal format which is used

- 25 by a user's device which joins the OVPN and a second signal format which is used in the

OVPN are different from each other; and

the converting section for performing the alternate converting operation in the OVPN terminating device,

wherein the converting section for performing the alternate converting operation

5 is provided with:

a transmitting section for transmitting the first signal format which is transmitted from the user's device to the OVPN by encapsulating the first signal format by the second signal format, and

a transmitting section for transmitting the encapsulated signal which is

10 encapsulated by the second signal format which is transmitted from the OVPN to the user's device by de-encapsulating to the first signal format, and

the transmitting section to the OVPN is provided with:

a multiplying section for multiplying a plurality of signals by the second signal format which are directed to a common destination; and

15 the transmitting section to the user's device is provided with a separating section for the multiplied signal by the multiplying section into a plurality of signals.

36. An OVPN system comprising:

a plurality of converting sections, which are disposed so as to correspond to 20 plural different first signal formats, for converting a first signal format and a second signal format alternately under conditions in which the first signal format which is used by a user's device which joins an OVPN and a second signal format which is used in the OVPN are different from each other, wherein

the converting section for performing the alternate converting operation is

25 provided with:

- a transmitting section for transmitting the first signal format which is transmitted from the user's device to the OVPN by encapsulating the first signal format by the second signal format, and
- a transmitting section for transmitting the encapsulated signal which is
- 5   encapsulated by the second signal format which is transmitted from the OVPN to the user's device by de-encapsulating according to the first signal format, and
- the transmitting section to the OVPN is provided with a dividing and encapsulating section for dividing and encapsulating a series of signals according to the first signal format into a plurality of signals according to the second signal format, and
- 10   the transmitting section to the user's device is provided with a restoring section for restoring a plurality of signals which are divided by the dividing and encapsulating section into a series of signals.
37. An OVPN terminating device for containing a user's device which joins an OVPN
- 15   comprising:
- a plurality of converting sections, which are disposed so as to correspond to plural different first signal formats, for converting a first signal format and a second signal format alternately under conditions in which the first signal format which is used by a user's device which joins the OVPN and a second signal format which is used in the
- 20   OVPN are different from each other, wherein
- the converting section for performing the alternate converting operation is provided with:
- a transmitting section for transmitting the first signal format which is transmitted from the user's device to the OVPN by encapsulating the first signal format by the
- 25   second signal format, and

a transmitting section for transmitting the encapsulated signal which is encapsulated by the second signal format which is transmitted from the OVPN to the user's device by de-encapsulating to the first signal format, and

- the transmitting section to the OVPN is provided with a dividing and
- 5    encapsulating section for dividing and encapsulating a series of signals according to the first signal format into a plurality of signals according to the second signal format, and  
            the transmitting section to the user's device is provided with a restoring section for restoring a plurality of signals which are divided by the dividing and encapsulating section into a series of signals.

10

38. A collective converting device comprising:

- a plurality of converting sections, which are disposed so as to correspond to plural different first signal formats, for converting a first signal format and a second signal format alternately under conditions in which the first signal format which is used  
15    by a user's device which joins an OVPN and a second signal format which is used in the OVPN are different from each other; and  
            a section for performing the alternate converting operation which is disposed in the OVPN terminating device according to any one of Claim 34 or 35 commonly.

20    39. An optical communication network which is provided with:

an OVPN system according to Claim 34 or 36, or an OVPN terminating device according to any one of Claim 35 or 37, or a collective converting device according to Claim 38.

25    40. An OVPN system comprising:

a plurality of converting sections, which are disposed so as to correspond to plural different first signal formats, for converting a first signal format in a layer 1 which is employed in a user's device which joins an OVPN and a second signal format which is prior to the layer 1 which is employed in the OVPN alternately, wherein

- 5       the converting section for performing the alternate converting operation is provided with:

          a transmitting section for transmitting the first signal format which is transmitted from the user's device to the OVPN by encapsulating the first signal format by the second signal format, and

- 10      a transmitting section for transmitting the encapsulated signal which is encapsulated by the second signal format which is transmitted from the OVPN to the user's device by de-encapsulating according to the first signal format.

41. An OVPN system according to Claim 40 wherein the transmitting section to the  
15 OVPN is provided with a multiplying section for multiplying a plurality of signals according to the second signal format.

42. An OVPN system according to Claim 40 wherein the transmitting section to the  
      OVPN is provided with a dividing and encapsulating section for dividing and  
20 encapsulating a series of signals according to the first signal format into a plurality of signals according to the second signal format.

43. An OVPN terminating device for containing a user's device which joins an OVPN comprising:  
25       a plurality of converting sections, which are disposed so as to correspond to

plural different first signal formats, for converting a first signal format and a second signal format alternately under conditions in which the first signal format which is used by a user's device which joins the OVPN and a second signal format which is used in the OVPN are different from each other; and

- 5       the converting section for performing the alternate converting operation in the OVPN terminating device, wherein

          the converting section for performing the alternate converting operation is provided with:

- a transmitting section for transmitting the first signal format which is transmitted  
10      from the user's device to the OVPN by encapsulating the first signal format by the second signal format, and  
          a transmitting section for transmitting the encapsulated signal which is encapsulated by the second signal format which is transmitted from the OVPN to the user's device by de-encapsulating to the first signal format.

15

44. An OVPN terminating device according to Claim 43 wherein the transmitting section to the OVPN is provided with a multiplying section for multiplying a plurality of signals according to the second signal format.

- 20      45. An OVPN terminating device according to Claim 43 wherein the transmitting section to the OVPN is provided with a dividing and encapsulating section for dividing and encapsulating a series of signals according to the first signal format into a plurality of signals according to the second signal format.

- 25      46. A collective converting device comprising:

a plurality of converting sections, which are disposed so as to correspond to plural different first signal formats, for converting a first signal format in a layer 1 which is employed in a user's device which joins an OVPN and a second signal format which is prior to the layer 1 which is employed in the OVPN alternately, and

- 5       the converting section for performing the alternate converting operation for the OVPN terminating device according to any one Claim 43 to 45 commonly.

47. An optical communication network which is provided with:

- an OVPN system according to any one of Claims 40 to 42, or an OVPN  
10     terminating device according to any one of Claims 43 to 45, or a collective converting device according to Claim 46.

48. An OVPN system comprising:

- a plurality of converting sections, which are disposed so as to correspond to  
15     plural different first signal formats, for converting a first signal format and a second signal format alternately under conditions in which the first signal format which is used by a user's device which joins an OVPN and a second signal format which is used in the OVPN are different from each other; and

- 20     a receiving and transmitting section for receiving a notice that the user's device is connected to the base point device via the control channel from the base point device which is disposed between the user's device and the OVPN and transmitting the IP address and the VPNID which are allocated to the user's device according to the base point device.

- 25     49. An OVPN terminating device for containing a user's device which joins an OVPN

comprising:

- a plurality of converting sections, which are disposed so as to correspond to plural different first signal formats, for converting a first signal format and a second signal format alternately under conditions in which the first signal format which is used
- 5 by a user's device which joins the OVPN and a second signal format which is used in the OVPN are different from each other; and
- a receiving and transmitting section for receiving a notice that the user's device is connected to the base point device via the control channel from the base point device which is disposed between the user's device and the OVPN and transmitting the IP
- 10 address and the VPNID which are allocated to the user's device according to the base point device.

50. An OVPN terminating device according to Claim 49 comprising:

- a receiving section for receiving a receipt confirmation which is transmitted
- 15 from a transmitting section for the IP address and the VPNID for the IP address and the VPNID; and
- a transmitting section for transmitting a final connection confirmation for notifying the receipt of the receipt confirmation by the receiving section to the base point device.

20

51. An OVPN terminating device according to Claim 49 or 50 comprising:

- a receiving and retrieving section for receiving the first signal format type information which is employed by the user's device according to the control channel after the final connection confirmation is transmitted so as to retrieving whether or not
- 25 there is a converting section for performing the alternate converting operation so as to

correspond to the format type; and

a registering section for registering the IP address and the VPNID which are allocated to the user's device, and the first signal format type information which is employed by the user's device when the retrieving result in the receiving and registering section indicates that there is a converting section for performing the alternate converting operation.

5 52. An OVPN terminating device according to any one of Claims 49 to 51 which is provided with the converting section for performing the alternate converting operation in  
10 the OVPN terminating device.

53. A base point device which is disposed between the OVPN terminating device according to any one of Claim 49 to 51 and a user's device which is contained in the OVPN terminating device comprising:

15 a detecting section for detecting whether or not the user's device is connected to the base point device;

a notifying section for notifying at least one of the OVPN terminating device via the control channel that it is detected that the user's device is connected to the base point device;

20 a receiving section for receiving the IP address and the VPNID which are allocated to the user's device from the OVPN terminating device via the control channel;

a transmitting section for transmitting a receipt confirmation that the receiving section received the IP address and the VPNID to the OVPN terminating device; and

25 a transmitting section the first signal format type information which is used by the user's device, the IP address, and the VPNID to the OVPN terminating device which

received the final connection receipt for the receipt confirmation via the control channel.

54. A base point device according to Claim 53 comprising:

- a determining section for determining the first signal format type information  
5 which is employed in the user's device; and  
a transmitting device for transmitting the format type information which is determined by the determining section to the OVPN terminating device.

55. A base point device according to Claim 53 or 54 comprising:

- 10 a separating section for separating the user's device and the OVPN; and  
a returning section for returning a test beam which is emitted from the OVPN back to the OVPN.

56. A collective converting device comprising:

- 15 a plurality of converting sections, which are disposed so as to correspond to plural different first signal formats, for converting a first signal format and a second signal format alternately under conditions in which the first signal format which is used by a user's device which joins the OVPN and a second signal format which is used in the OVPN are different from each other; and  
20 a converting section for the alternate converting operation for the OVPN terminating device according to any one of Claims 49 to 52 commonly.

57. An optical communication network which is provided with:

- an OVPN system according to Claim 48, or an OVPN terminating device  
25 according to any one of Claim 49 or 52, or a base point device according to any one of

Claims 53 to 55, or a collective converting device according to Claim 56.

58. A base point device which is disposed between an OVPN and a user's device comprising:

5           a plurality of converting sections, which are disposed so as to correspond to plural different first signal formats, for converting a first signal format and a second signal format alternately under conditions in which the first signal format which is used by a user's device which joins the OVPN and a second signal format which is used in the OVPN are different from each other;

10           a multiplying and transmitting section for multiplying and transmitting a plurality of optical wavelength signals which are used in the user's device to the OVPN; a separating and transmitting section for separating and transmitting the multiplied optical wavelength signals which arrive from the OVPN; and a notifying section for notifying the OVPN of information for the wavelength which are transmitted under a multiplied condition so as to be used in a plurality of the user's devices.

59. An OVPN terminating device for containing the user's device via the base point device according to Claim 58 comprising:

20           a plurality of converting sections, which are disposed so as to correspond to plural different first signal formats, for converting a first signal format and a second signal format alternately under conditions in which the first signal format which is used by a user's device which joins the OVPN and a second signal format which is used in the OVPN are different from each other;

25           a multiplying and transmitting section for multiplying and transmitting a

plurality of optical wavelength signals which are used in the user's device to the OVPN;  
and

a separating and transmitting section for separating and transmitting the  
multiplied optical wavelength signals which arrive from the base point device so as to  
5 transmit to a predetermined course according to information which is notified from the  
notifying section.

60. A base point device which is disposed between an OVPN and a user's device  
comprising:

- 10 a plurality of converting sections, which are disposed so as to correspond to plural different first signal formats, for converting a first signal format and a second signal format alternately under conditions in which the first signal format which is used by a user's device which joins the OVPN and a second signal format which is used in the OVPN are different from each other;
- 15 a converting and transmitting section for converting a serial signal which is transmitted from the user's device into a plurality of parallel signals so as to transmit to the OVPN;  
a converting and transmitting section for converting a plurality of the parallel signals which arrive from the OVPN into a serial signal so as to transmit to the user's  
20 device; and  
a notifying section for notifying the OVPN of information for the topology of the parallel signals and information that the serial signals are converted to the parallel signals.
- 25 61. An OVPN terminating device for containing the user's device via the base point

device according to Claim 60 comprising:

- a plurality of converting sections, which are disposed so as to correspond to plural different first signal formats, for converting a first signal format and a second signal format alternately under conditions in which the first signal format which is used by a user's device which joins the OVPN and a second signal format which is used in the OVPN are different from each other; and
  - an inputting section for inputting the parallel signals which are divided from a series of serial signals in to a plurality of the converting section for performing the alternate converting operation so as to correspond to the first signal format type information according to the information which is notified from the notifying section in the base point device according to Claim 60.

62. A base point device which is disposed between an OVPN and a user's device comprising:

- 15 a plurality of converting sections, which are disposed so as to correspond to plural different first signal formats, for converting a first signal format and a second signal format alternately under conditions in which the first signal format which is used by a user's device which joins the OVPN and a second signal format which is used in the OVPN are different from each other;
- 20 a multiplying and transmitting section for multiplying the parallel signal which is converted from the serial signal which is transmitted from the user's device so as to transmit to the OVPN;
  - a separating and transmitting section for separating the multiplied wavelength signals which arrive from the OVPN into the parallel signals and converting the parallel signals into the serial signals so as to transmit to the user's device; and

a notifying section for notifying the OVPN of the information that the serial signals are converted to the parallel signals, the information for a topology of the parallel signals, and the information that the parallel signals are transmitted under wavelength-multiplied condition.

5

63. An OVPN terminating device for containing the user's device via the base point device according to Claim 62 comprising:

10        a plurality of converting sections, which are disposed so as to correspond to plural different first signal formats, for converting a first signal format and a second signal format alternately under conditions in which the first signal format which is used by a user's device which joins the OVPN and a second signal format which is used in the OVPN are different from each other;

15        a multiplying and transmitting section for multiplying the parallel signals which arrive from the OVPN as to transmit to the base point device;

20        a separating and transmitting section for separating the multiplied optical wavelength signals which arrive from the base point device so as to transmit to the OVPN as the parallel signals; and

25        an inputting section for inputting the parallel signals which are divided from a the multiplied wavelength signals into a plurality of the converting section for performing the alternate converting operation so as to correspond to the first signal format type information according to the information which is notified from the notifying section in the base point device.

64. An OVPN system comprising:

25        a plurality of converting sections, which are disposed so as to correspond to

plural different first signal formats, for converting a first signal format and a second signal format alternately under conditions in which the first signal format which is used by a user's device which joins an OVPN and a second signal format which is used in the OVPN are different from each other,

- 5        wherein at least a part of the converting sections for performing the alternate converting operation are provided with converting sections for converting a series of serial signals according to the first signal format which are transmitted from the user's device into a plurality of parallel signals in the OVPN according to the second signal format and converting a plurality of the parallel signals according to the second signal
- 10      format directed to the user's device from the OVPN into a series of serial signals according to the first signal format alternately.

65. An OVPN terminating device for containing the user's device which joins the OVPN comprising:

- 15        a plurality of converting sections, which are disposed so as to correspond to plural different first signal formats, for converting a first signal format and a second signal format alternately under conditions in which the first signal format which is used by a user's device which joins the OVPN and a second signal format which is used in the OVPN are different from each other;
- 20        a converting section for performing the alternate converting operation in the OVPN terminating device,  
              wherein at least a part of the converting sections for performing the alternate converting operation include converting sections for converting a series of serial signals according to the first signal format which are directed to the OVPN from the user's device into a plurality of parallel signals in the OVPN according to the second signal

format and converting a plurality of the parallel signals according to the second signal format directed to the user's device from the OVPN into a series of serial signals according to the first signal format alternately.

5     66. An OVPN terminating device according to any one of Claims 59, 61, or 63 which is provided with the converting section for performing the alternate converting operation in the OVPN terminating device.

10    67. A base point device according to any one of Claim 58, 60, or 62 which is provided with:

a separating section for separating the user's device and the OVPN; and  
a returning section for returning a test beam which is transmitted from the OVPN back to the OVPN.

15    68. A collective converting device comprising:

a plurality of converting sections, which are disposed so as to correspond to plural different first signal formats, for converting a first signal format and a second signal format alternately under conditions in which the first signal format which is used by a user's device which joins an OVPN and a second signal format which is used in the

20    OVPN are different from each other; and

a section for performing the alternate converting operation which is disposed in the OVPN terminating device according to any one of Claim 59, 61, or 63 commonly.

69. An optical communication network which is provided with:

25    a base point device according to any one of Claim 58, 60, 62 or 67, or an OVPN

terminating device according to any one of Claim 59, 61, 63, or 65, or a collective  
converting device according to Claim 68.

70. A base point device which is disposed between an OVPN system and a user's  
5 device comprising:

- a plurality of converting sections, which are disposed so as to correspond to plural different first signal formats, for converting a first signal format and a second signal format alternately under conditions in which the first signal format which is used by a user's device which joins an OVPN and a second signal format which is used in the 10 OVPN are different from each other;
- a recording section for recording a group for the base point device which relates to a common VPNID;
- a detecting section for detecting an occurrence of a failure in a control channel and a data channel;
- 15 a requesting section for requesting that other base point device in a same group should perform processes which is supposed to be performed by the detecting section which has a failure with reference to the recording section.

71. A base point device which is disposed between an OVPN terminating device for  
20 containing a user's device which joins the OVPN and the user's device and connected to a plurality of OVPN terminating devices comprising:
- a plurality of converting sections, which are disposed so as to correspond to plural different first signal formats, for converting a first signal format and a second signal format alternately under conditions in which the first signal format which is used 25 by a user's device which joins an OVPN and a second signal format which is used in the

OVPN are different from each other;

a recording section for recording a group for the OVPN terminating device

which relates to a common VPNID;

a detecting section for detecting an occurrence of a failure in a control channel

5 and a data channel;

a requesting section for requesting that other OVPN terminating device in a same group should perform processes which is supposed to be performed by the OVPN terminating device which has a failure in the control channel with reference to the recording section when the detecting section detects the occurrence of the failure.

10

72. A base point device according to Claim 70 or 71 which is provided with:

a separating section for separating the user's device and the OVPN; and

a returning section for returning a test beam which is transmitted from the

OVPN back to the OVPN.

15

73. An OVPN terminating device for containing a user's device which joins an OVPN comprising:

a plurality of converting sections, which are disposed so as to correspond to plural different first signal formats, for converting a first signal format and a second

20 signal format alternately under conditions in which the first signal format which is used by a user's device which joins the OVPN and a second signal format which is used in the OVPN are different from each other;

a recording section for recording a group for the OVPN terminating device which relates to a common VPNID;

25 a detecting section for detecting an occurrence of a failure in a control channel

and a data channel;

a requesting section for requesting that other OVPN terminating device in a same group should perform processes which is supposed to be performed by the OVPN terminating device which has a failure in the control channel with reference to the 5 recording section when the detecting section detects the occurrence of the failure.

74. An optical communication network which is provided with a base point device according to Claim 70 or 72, or the OVPN terminating device according to Claim 73.